

WHAT IS CLAIMED IS:

5 1. A foreground object and background
sprite separation and extraction method for
extracting a foreground object and a background
sprite, comprising the steps of:

obtaining a global motion for transforming
a coordinate system between a reference frame and a
frame for each of frames in a moving image;

10 mapping an original image corresponding to
said frame into a reference coordinate system for
said each of frames by using said global motion, and
obtaining a pixel value at a point in said reference
coordinate system from pixel values of pixels which
15 exist in the same point;

generating a provisional sprite where
foreground objects are deleted;

cutting out a first image from said
provisional sprite by using said global motion;

20 obtaining a difference image between said
first image and said original image;

extracting a foreground object image as a
region in said difference image where each
difference value in the region is equal to or higher
25 than a threshold, and extracting other region as a
background image;

mapping said background image to said
reference coordinate system by using said global
motion for said each of frames by inserting a new
30 pixel in a point where a pixel value is not yet
decided, or by overwriting a pixel, for generating
and outputting said background sprite.

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2. The foreground object and background

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sprite separation and extraction method as claimed
in claim 1, further comprising the steps of:

cutting out a second image from said
background sprite by using said global motion;

5 obtaining a difference image between said
second image and said original image;

extracting a foreground object image as a
region in said difference image where each
difference value in the region is equal to or higher
10 than a threshold.

15 3. A foreground object and background
sprite separation and extraction apparatus for
extracting a foreground object and a background
sprite, comprising:

means for obtaining a global motion for
20 transforming a coordinate system between a reference
frame and a frame for each of frames in a moving
image;

means for mapping an original image
corresponding to said frame into a reference
25 coordinate system for said each of frames by using
said global motion, and obtaining a pixel value at a
point in said reference coordinate system from pixel
values of pixels which exist in the same point;

means for generating a provisional sprite
30 where foreground objects are deleted;

means for cutting out a first image from
said provisional sprite by using said global motion;

means for obtaining a difference image
between said first image and said original image;

35 means for extracting a foreground object
image as a region in said difference image where
each difference value in the region is equal to or

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higher than a threshold, and extracting other region as a background image;

means for mapping said background image to said reference coordinate system by using said global motion for said each of frames by inserting a new pixel in a point where a pixel value is not yet decided, or by overwriting a pixel, for generating and outputting said background sprite.

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4. The foreground object and background sprite separation and extraction apparatus as claimed in claim 3, further comprising:

means for cutting out a second image from said background sprite by using said global motion; means for obtaining a difference image between said second image and said original image; means for extracting a foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold.

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5. A computer readable medium storing program code for causing a computer to extract a foreground object and a background sprite, comprising:

program code means for obtaining a global motion for transforming a coordinate system between a reference frame and a frame for each of frames in a moving image;

program code means for mapping an original image corresponding to said frame into a reference

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coordinate system for said each of frames by using
said global motion, and obtaining a pixel value at a
point in said reference coordinate system from pixel
values of pixels which exist in the same point;

5 program code means for generating a
provisional sprite where foreground objects are
deleted;

10 program code means for cutting out a first
image from said provisional sprite by using said
global motion;

 program code means for obtaining a
difference image between said first image and said
original image;

15 program code means for extracting a
foreground object image as a region in said
difference image where each difference value in the
region is equal to or higher than a threshold, and
extracting other region as a background image;

20 program code means for mapping said
background image to said reference coordinate system
by using said global motion for said each of frames
by inserting a new pixel in a point where a pixel
value is not yet decided, or by overwriting a pixel,
for generating and outputting said background sprite.

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30 6. The computer readable medium as claimed
in Claim 5, further comprising:

 program code means for cutting out a
second image from said background sprite by using
said global motion;

35 program code means for obtaining a
difference image between said second image and said
original image;

 program code means for extracting a

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foreground object image as a region in said difference image where each difference value in the region is equal to or higher than a threshold.

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7. A segmentation mask extraction method in object coding in moving image coding, comprising the steps of:

receiving a foreground mask image where a foreground part is represented by a first value and a background part is represented by a second value;

providing a first value as an alpha value to all shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

providing said first value as said alpha value to all shape pixels in each of second macro-blocks when the number of pixels of said foreground part in said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said second macro-block is close to said first macro-block where said first value is provided; and

outputting said segmentation mask.

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8. The segmentation mask extraction method as claimed in claim 7, further comprising the steps of:

receiving each of third macro-blocks which has been determined as said background part; and providing said first value to said third

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macro-block when a difference image between a background image and an original image which correspond to said third macro-block includes a pixel which has a difference value equal to or
5 larger than a threshold.

10 9. A segmentation mask extraction method in object coding in moving image coding, comprising the steps of:
receiving a foreground mask image;
generating a number map by calculating the
15 number of pixels of a foreground part for each of macro-blocks in said foreground mask image;
initializing a foreground map;
providing a predetermined value to each of positions in said foreground map corresponding to
20 first macro-blocks when a value of said number map corresponding to said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);
providing said predetermined value to each of positions in said foreground map corresponding to
25 second macro-blocks when a value of said number map corresponding to said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said second macro-block is close to said first macro-block where said predetermined value is
30 provided; and
generating said segmentation mask from said foreground map and outputting said segmentation mask.

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10. A segmentation mask extraction apparatus in object coding in moving image coding, comprising:

means for receiving a foreground mask
5 image where a foreground part is represented by a first value and a background part is represented by a second value;

first macro-block approximation means for providing a first value as an alpha value to all
10 shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

second macro-block approximation means for providing said first value as said alpha value to
15 all shape pixels in each of second macro-blocks when the number of pixels of said foreground part in said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said
20 second macro-block is close to said first macro-block where said first value is provided in said first macro-block approximation means; and

means for outputting said segmentation mask.

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11. The segmentation mask extraction apparatus as claimed in claim 10, further
30 comprising:

means for receiving each of third macro-blocks which has been determined as said background part; and

means for providing said first value to
35 said third macro-block when a difference image between a background image and an original image which correspond to said third macro-block includes

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a pixel which has a difference value equal to or larger than a threshold.

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12. A segmentation mask extraction apparatus in object coding in moving image coding, comprising the steps of:

10 means for receiving a foreground mask image;

means for generating a number map by calculating the number of pixels of a foreground part for each of macro-blocks in said foreground mask image;

15 means for initializing a foreground map; means for providing a predetermined value to each of positions in said foreground map corresponding to first macro-blocks when a value of said number map corresponding to said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

20 means for providing said predetermined value to each of positions in said foreground map corresponding to second macro-blocks when a value of said number map corresponding to said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said second macro-block is close to said first macro-block where said predetermined value is provided; and

30 generating said segmentation mask from said foreground map and outputting said segmentation mask.

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13. A computer readable medium storing program code for causing a computer to extract a segmentation mask in object coding in moving image coding, comprising:

5 program code means for receiving a foreground mask image where a foreground part is represented by a first value and a background part is represented by a second value;

10 first macro-block approximation program code means for providing a first value as an alpha value to all shape pixels in each of first macro-blocks when the number of pixels of said foreground part in said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

15 second macro-block approximation program code means for providing said first value as said alpha value to all shape pixels in each of second macro-blocks when the number of pixels of said foreground part in said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said second macro-block is close to said first macro-block where said first value is provided in said first macro-block approximation program code means; and

25 program code means for outputting said segmentation mask.

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14. The computer readable medium as claimed in claim 13, further comprising:

35 program code means for receiving each of third macro-blocks which has been determined as said background part; and

 program code means for providing said first value to said third macro-block when a

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difference image between a background image and an original image which correspond to said third macro-block includes a pixel which has a difference value equal to or larger than a threshold.

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15. A computer readable medium storing
10 program code for causing a computer to extract a segmentation mask in object coding in moving image coding, comprising:

program code means for receiving a foreground mask image;

15 program code means for generating a number map by calculating the number of pixels of a foreground part for each of macro-blocks in said foreground mask image;

20 program code means for initializing a foreground map;

program code means for providing a predetermined value to each of positions in said foreground map corresponding to first macro-blocks when a value of said number map corresponding to
25 said first macro-block is equal to or larger than a first predetermined value n ($n \geq 1$);

program code means for providing said predetermined value to each of positions in said foreground map corresponding to second macro-blocks
30 when a value of said number map corresponding to said second macro-block is equal to or larger than a second predetermined value m ($m < n$), wherein said second macro-block is close to said first macro-block where said predetermined value is provided;

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program code generating said segmentation mask from said foreground map and outputting said

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segmentation mask.

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16. A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising the steps of:

10 obtaining said difference image by calculating an absolute difference between said background image and said image for each pixel; initializing an energy map for each macro-block of said difference image;

15 calculating energy values for said each macro-block; obtaining an average of said energy values;

20 calculating a foreground ratio which is a ratio of the size of a foreground mask to the size of said image; and generating said segmentation mask by using said foreground ratio.

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17. The segmentation mask extraction method as claimed in claim 16, further comprising the steps of:

30 obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as an energy value to a macro-block when said divided value is equal to or

35 smaller than α ($\alpha \geq 1.0$); obtaining a maximum energy value as a first predetermined value, setting a second

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predetermined value which is smaller than said first predetermined value, and initializing a foreground map;

5 initializing a temporary foreground map;
 providing a predetermined value to each
macro-block position in said temporary foreground
map where said energy value is equal to or larger
than said first predetermined value;
 counting a count number of macro-blocks
10 where said temporary foreground map has said
predetermined value;
 generating said segmentation mask from
said foreground map and outputting said segmentation
mask if a value obtained by dividing said count
15 number by the number of all macro-blocks is larger
than a third predetermined value which is
predetermined, if not, copying values of said
temporary foreground map to said foreground map;
 iterating a providing step until a divided
20 number obtained by dividing said count number by the
number of all macro-blocks becomes larger than said
third predetermined value, wherein said providing
step is a step of providing said predetermined value
to each macro-block position in said temporary
25 foreground map where said energy value is equal to
or larger than said second predetermined value, said
each macro-block being close to a macro-block which
has said predetermined value in said foreground map;
 when said divided number does not become
30 larger than said third predetermined value after
iterating said providing step, copying values of
said temporary foreground map to said foreground map,
updating said first predetermined value and said
second predetermined value, and performing said
35 steps after said step of initializing said temporary
foreground map.

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18. A segmentation mask extraction
5 apparatus for extracting a segmentation mask by
using a difference image between a background image
and an image, comprising:
means for obtaining said difference image
by calculating an absolute difference between said
10 background image and said image for each pixel;
means for initializing an energy map for
each macro-block of said difference image;
means for calculating energy values for
said each macro-block;
15 means for obtaining an average of said
energy values;
means for calculating a foreground ratio
which is a ratio of the size of a foreground mask to
the size of said image; and
20 means for generating said segmentation
mask by using said foreground ratio.

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19. The segmentation mask extraction
method as claimed in claim 18, comprising:
means for obtaining a divided value by
dividing said energy value by said average for said
30 each macro-block, and providing 0 as an energy value
to a macro-block when said divided value is equal to
or smaller than α ($\alpha \geq 1.0$);
means for obtaining a maximum energy value
as a first predetermined value, setting a second
35 predetermined value which is smaller than said first
predetermined value, and initializing a foreground
map;

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means for initializing a temporary foreground map;

means for providing a predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said first predetermined value;

means for counting a count number of macro-blocks where said temporary foreground map has said predetermined value;

means for generating said segmentation mask from said foreground map and outputting said segmentation mask if a value obtained by dividing said count number by the number of all macro-blocks is larger than a third predetermined value which is predetermined, if not, copying values of said temporary foreground map to said foreground map;

means for iterating a providing step until a divided number obtained by dividing said count number by the number of all macro-blocks becomes larger than said third predetermined value, wherein said providing step is a step of providing said predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said second predetermined value, said each macro-block being close to a macro-block which has said predetermined value in said foreground map;

means for copying values of said temporary foreground map to said foreground map, updating said first predetermined value and said second predetermined value, and performing said steps after said step of initializing said temporary foreground map, when said divided number does not become larger than said third predetermined value after iterating said providing step.

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20. A computer readable medium storing
program code for causing a computer to extract a
5 segmentation mask by using a difference image
between a background image and an image, comprising:
program code means for obtaining said
difference image by calculating an absolute
difference between said background image and said
10 image for each pixel;
program code means for initializing an
energy map for each macro-block of said difference
image;
program code means for calculating energy
15 values for said each macro-block;
program code means for obtaining an
average of said energy values;
program code means for calculating a
foreground ratio which is a ratio of the size of a
20 foreground mask to the size of said image; and
program code means for generating said
segmentation mask by using said foreground ratio.

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21. The computer readable medium as
claimed in claim 20, comprising:
program code means for obtaining a divided
30 value by dividing said energy value by said average
for said each macro-block, and providing 0 as an
energy value to a macro-block when said divided
value is equal to or smaller than α ($\alpha \geq 1.0$);
program code means for obtaining a maximum
35 energy value as a first predetermined value, setting
a second predetermined value which is smaller than
said first predetermined value, and initializing a

foreground map;

program code means for initializing a temporary foreground map;

program code means for providing a
5 predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said first predetermined value;

program code means for counting a count
10 number of macro-blocks where said temporary foreground map has said predetermined value;

program code means for generating said segmentation mask from said foreground map and outputting said segmentation mask if a value
15 obtained by dividing said count number by the number of all macro-blocks is larger than a third predetermined value which is predetermined, if not, copying values of said temporary foreground map to said foreground map;

program code means for iterating a providing step until a divided number obtained by dividing said count number by the number of all macro-blocks becomes larger than said third predetermined value, wherein said providing step is
20 a step of providing said predetermined value to each macro-block position in said temporary foreground map where said energy value is equal to or larger than said second predetermined value, said each macro-block being close to a macro-block which has
25 said predetermined value in said foreground map;

program code means for copying values of said temporary foreground map to said foreground map, updating said first predetermined value and said second predetermined value, and performing said
30 steps after said step of initializing said temporary foreground map, when said divided number does not become larger than said third predetermined value
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after iterating said providing step.

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22. A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising:

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a first step of regarding each of first macro-blocks as the foreground when an energy value of said first macro-block which is obtained by said difference image is equal to or larger than a first predetermined value;

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a second step of regarding each of second macro-blocks as the foreground when an energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to a macro-block which is determined as the foreground in said first step.

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23. The segmentation mask extraction method as claimed in claim 22, further comprising a step of iterating said second step for predetermined times.

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24. A segmentation mask extraction method for extracting a segmentation mask by using a difference image between a background image and an image, comprising the steps of:

calculating energy values of each macro-

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block from said difference image and calculating an average of said energy values;

obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as an energy value to a macro-block when said divided value is equal to or smaller than a predetermined value;

regarding each of first macro-blocks as the foreground when said energy value of said first macro-block is equal to or larger than a first predetermined value;

iterating, predetermined times, a step of regarding each of second macro-blocks as the foreground when said energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to said first macro-block which is determined as the foreground.

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25. A segmentation mask extraction apparatus for extracting a segmentation mask by using a difference image between a background image and an image, comprising:

first means for regarding each of first macro-blocks as the foreground when an energy value of said first macro-block which is obtained by said difference image is equal to or larger than a first predetermined value;

second means for regarding each of second macro-blocks as the foreground when an energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to a macro-block which is determined as the foreground in said first means.

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5 26. The segmentation mask extraction
apparatus as claimed in claim 25, further comprising
means for iterating the process by said second means
for predetermined times.

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 27. A segmentation mask extraction
apparatus for extracting a segmentation mask by
15 using a difference image between a background image
and an image, comprising:

 means for calculating energy values of
each macro-block from said difference image and
calculating an average of said energy values;

20 means for obtaining a divided value by
dividing said energy value by said average for said
each macro-block, and providing 0 as said energy
value to a macro-block when said divided value is
equal to or smaller than a predetermined value;

25 means for regarding each of first macro-
blocks as the foreground when said energy value of
said first macro-block is equal to or larger than a
first predetermined value;

 means for iterating, predetermined times,
30 a step of regarding each of second macro-blocks as
the foreground when said energy value of said second
macro-block is equal to or larger than a second
predetermined value, said second macro-block being
close to said first macro-block which is determined
35 as the foreground.

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28. A computer readable medium storing
program code for causing a computer to extract a
segmentation mask by using a difference image
between a background image and an image, comprising:

first program code means for regarding
each of first macro-blocks as the foreground when an
energy value of said first macro-block which is
obtained by said difference image is equal to or
larger than a first predetermined value;

second program code means for regarding
each of second macro-blocks as the foreground when
an energy value of said second macro-block is equal
to or larger than a second predetermined value, said
second macro-block being close to a macro-block
which is determined as the foreground in said first
program code means.

29. The computer readable medium as
claimed in claim 28, further comprising program code
means for iterating the process by said second
program code means for predetermined times.

30. A computer readable medium storing
program code for causing a computer to extract a
segmentation mask by using a difference image
between a background image and an image, comprising:
program code means for calculating energy
values of each macro-block from said difference
image and calculating an average of said energy

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values;

program code means for obtaining a divided value by dividing said energy value by said average for said each macro-block, and providing 0 as said
5 energy value to a macro-block when said divided value is equal to or smaller than a predetermined value;

program code means for regarding each of first macro-blocks as the foreground when said
10 energy value of said first macro-block is equal to or larger than a first predetermined value;

program code means for iterating, predetermined times, a step of regarding each of second macro-blocks as the foreground when said
15 energy value of said second macro-block is equal to or larger than a second predetermined value, said second macro-block being close to said first macro-block which is determined as the foreground.

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